

WHAT IS CLAIMED IS:

1. An optical device, comprising:

2       a membrane configured to be electrically deformable and  
3       reflective and positioned over a cavity located within a substrate;

4       a transmissive spacer coupled to said substrate and located  
5       over said cavity; and

6       a lens coupled to said transmissive spacer and optically  
7       aligned with said membrane.

2       2. The optical device as recited in Claim 1 further  
comprising a fiber holder coupled to said lens.

3       3. The optical device as recited in Claim 1 wherein said  
membrane is located over a first substrate having a first alignment  
mark and said transmissive spacer is formed from a second substrate  
having a second alignment mark that corresponds to said first  
alignment mark to provide alignment of said first substrate with  
said second substrate.

4. The optical device as recited in Claim 1 wherein said  
2 transmissive spacer comprises a material selected from the group  
3 consisting of:

4 silicon;  
5 ceramic;  
6 fused silica; and  
7 infrared-transparent optical glass.

5. The optical device as recited in Claim 1 wherein said  
2 transmissive spacer forms a lumen between said lens and said  
3 membrane and wherein said lumen contains air or an inert atmosphere  
4 or wherein at least a partial vacuum exists between said lens and  
5 said membrane.

6. The optical device as recited in Claim 1 wherein said  
2 transmissive spacer has a thickness substantially equal to a focal  
3 length of said lens.

7. The optical device as recited in Claim 1 further  
2 comprising terminals on an exterior of said optical device and  
3 connected to said membrane and configured to provide an electrical  
4 current to said membrane.

8. A method of manufacturing an optical device, comprising:

2           positioning a membrane configured to be electrically  
3           deformable and reflective over a cavity located within a substrate;  
4           coupling a transmissive spacer to said substrate such that  
5           said transmissive spacer is located over said cavity; and  
6           coupling a lens to said transmissive spacer and optically  
7           aligned with said membrane.

9. The method as recited in Claim 8 wherein positioning

2 further includes positioning a plurality of said membranes over a  
3 corresponding one of a plurality of cavities located in said  
4 substrate, and wherein coupling a transmissive spacer further  
5 includes coupling a transmissive spacer to each of said membranes,  
6 and coupling a lens includes coupling a lens to each of said  
7 transmissive spacers, and the method further includes coupling a  
8 fiber holder to each of said lenses.

10. The method as recited in Claim 8 further comprising

2 coupling a fiber holder to said lens.

11. The method as recited in Claim 8 wherein said membrane is  
2 formed on a first substrate having a first alignment mark, and said  
3 transmissive spacer is formed from a second substrate having a  
4 second alignment mark, and wherein coupling said transmissive  
5 spacer includes coupling said second substrate to said first  
6 substrate by using said first and second alignment marks.

12. The method as recited in Claim 8 wherein coupling a lens  
2 includes coupling a lens that has focal length substantially equal  
3 to a thickness of said transmissive spacer.

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13. An optical system, comprising:

2           an optical transmitter;

3           an optical receiver; and

4           an optical device array, including:

5                 membranes each configured to be electrically deformable  
6                 and reflective and positioned over a corresponding one of a  
7                 plurality of cavities located within a substrate;

8                 a transmissive spacer coupled to said substrate and  
9                 located over each of said cavities; and

10                a lens coupled to each of said transmissive spacers and  
11                optically aligned with each of said membranes.

14. The optical system as recited in Claim 13 further  
comprising a fiber holder coupled to each of said lenses.

15. The optical system as recited in Claim 13 wherein said  
2         membranes are located over a first substrate having a first  
3         alignment mark and said transmissive spacers are formed from a  
4         second substrate having a second alignment mark that corresponds to  
5         said first alignment mark to provide alignment of said first  
6         substrate with said second substrate.

16. The optical system as recited in Claim 13 wherein each of  
2 said transmissive spacers comprises a material selected from the  
3 group consisting of:

4 silicon;  
5 ceramic;  
6 fused silica; and  
7 infrared-transparent optical glass.

17. The optical system as recited in Claim 13 wherein each of  
2 said transmissive spacers forms a lumen between each of said lenses  
3 and each of said membranes and wherein each of said lumens contains  
4 air or an inert atmosphere or wherein at least a partial vacuum  
5 exists between each of said lenses and said membranes.

18. The optical system as recited in Claim 13 where each of  
2 said transmissive spacers has a thickness substantially equal to a  
3 focal length of each of said lenses.

19. The optical system as recited in Claim 13 further  
2 comprising terminals on an exterior of said device and connected to  
3 each of said membranes and configured to provide an electrical  
4 current to each of said membranes.

20. The optical system as recited in Claim 13 wherein said  
2       optical system further includes an optical switch and said optical  
3       forms a part of said optical switch.